FIRE!
Aircraft Destroyed, Hangars Destroyed!

In the last few years, we have heard of several incidents of aircraft and hangars or other property being lost because of fires caused by static discharge while an airplane is being fueled or, in some cases, where fuel is being drained from aircraft. This phenomenon appears to be the most severe in winter, but this is not something that is solely associated with the colder months. Several years ago in mid-July on a warm 70-degree day, a *Super Cub* caught fire while being refueled from plastic jugs at Lake Hood. A static electricity discharge ignited the fumes while refueling was taking place. The pilot received burns over most of his body and the aircraft was saved because of the timely help of an operator close by who had a fire extinguisher readily available. The following articles from Alaska, New Zealand, and Canada explain how this happens and the need for proper bonding of the aircraft.

"Don't Take Any Static"

By Bill Missal

Static electricity is a phenomenon that occurs whenever two objects or substances come in contact with each other and then are separated. The separation action causes an electric charge to build between the two objects. The charge remains in a "static" condition, unless and until there is an avenue for discharge. The discharge usually occurs rapidly and is seen as a spark between objects. If the static does not discharge rapidly, it will slowly dissipate over time, but this is dependent on several factors and may not be predictable. The static charge will not build up, however, if the two objects are connected by a bonding wire that keeps them at the same electric potential.

When this initial separation occurs, an electric charge can also build up between either of those two objects and others that are in the area. This secondary charge, which may be at a different level than the primary charge, remains until there is an avenue to equalize the difference. If any of these objects comes close enough to another, those two will discharge and a spark will occur. However, other static charges that have built up might not be equalized and may still exist. Again, it is important to know that a static charge will not build up between any two objects that are electrically bonded to each other even though charges have developed between surrounding objects.

Natural Static Conditions

One of the most frequent natural static conditions occurs during rain. The action of water droplets separating from clouds and from each other as they fall causes an electric charge to develop between the clouds and the droplets. The droplets carry this charge to the earth's surface which then has a different electric potential from the cloud. Either the cloud or the ground can be either positive (+) or negative (-). The electric charge on the surface is usually equalized across the ground by the layer of water that is left as the droplets spread out over the rocks, buildings, vehicles, etc. However, the electrical difference between the cloud and the surface is not equalized. Also, as the cloud moves along, driven by the wind, this charge moves with it, even after the rain has stopped. Any objects on the ground, such a building, fuel tanks, and vehicles, are affected and develop that same electrical difference with the cloud as it passed overhead. In addition, other objects that are not electrically bonded to the ground and other clouds may develop a different charge level than already exits. Even if the main charge between the ground and cloud discharge through lightening, these secondary charges may remain in the "static" condition. It is this part of the phenomenon that is a hazard around aircraft that are being fueled.

Bonding

In general terms, aircraft and fuel trucks, storage tanks, fuel drums, or gas cans are not normally connected unless actual fueling is being performed. Static charges can exist between any of them at any time. If there is or has been a rain, thunder, or lightening storm, it is likely that static charges have built up and need to be dissipated. This is particularly likely with aircraft since they are usually separated from the ground and from fuel, tanks, drums, or cans by the rubber tires. This charge will not be dissipated, unless one of these objects is brought close enough to the aircraft for the electrical difference to discharge. If this discharge occurs rapidly when a fuel nozzle is being brought close to an aircraft's fuel tank opening, the spark can, and likely will, ignite the fuel vapors. If the vapors are in a high enough concentration, an explosion will occur.

To avoid this situation, fuel trucks, fuel drums, or gas cans should be electrically connected to the aircraft before being brought close to begin fueling. The proper way is by using a bonding or grounding wire. This will put them at the same electrical potential and a static charge, if it was present, will no longer exist. In fact, to ensure proper bonding, we should follow this sequence. The truck, tank, or can should be electrically bonded to the ground first. Then the aircraft should be electrically bonded to the ground. And the last step is to bond the truck, tank, or can to the aircraft before the hose and nozzle are brought to the aircraft. Any static charges that were present will be discharged through the bonding wires, and these wires will prevent additional charges from building during the fueling process. Remember that fuel being poured into a fuel tank will develop static charges just like the rain, if electrical bonding is not present.

One situation that we often encounter is the use of plastic cans to refuel aircraft. Although a plastic can itself cannot transmit an electric current, a static charge can build up between the plastic can and the aircraft or the fuel within the can and the aircraft. A spark can occur when this charge equalizes and, again, the strength and likelihood of that spark is dependent on the amount of charge that has built up. This is much like the static charge that can build when running a plastic comb through your hair or that develops between clothing and your skin. The same cautions should be taken with plastic cans as with other fueling containers. One method is to ensure that the spout of the can is actually touching the side of the fuel tank opening at all times during the fueling. Thus, any possibility of a charge would be dissipated immediately and no spark would occur.

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